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The Weakening Effect on a Species of Plants of Being Continually Reproduced by Artificial Means.

E. F. A. REINISCH.

The natural reproduction of plants is by their seeds, like all of our cereals, grasses, annual flowering plants, etc.

The artificial methods are root divisions, layering, grafting, and cuttings. However careful the artificial operations are performed, there is always a surface unprotected by bark or callus, which is exposed to the soil and its moisture contents till the plant is able to gradually heal the wound by its own life force. Until this is done there are many chances for disease to attack the small exposed surface and retard the process of healing, sometimes preventing it entirely, in which case the bark decays back at some little distance to where roots existed or have been newly formed.

In division, the section taken away to form a new plant receives a portion of the root stock of the mother plant, and with it life and energy to start out as a new individual.

In layering, the new plant to-be is a branch or stem, a portion of which is layered in the soil with the top projecting out of it. This is left in the ground during the growing season, when roots are formed, induced by the moisture of the ground. The following dormant season the branch or stem is cut off at the ground next to the mother plant, dug up, and planted as a new individual.

In grafting, the species or variety to be propagated is worked on another plant of the same or a related genus or species by inserting a bud under the bark, or by other modes of grafting when twigs or scions are used instead of buds.

In the preceding two artificial methods of reproduction the new plant has been attached to some growing plant, from which it received life and nourishment until it became a self-sustaining individual. In this last method—propagation by cuttings—a piece of the plant to be propagated is cut off and inserted into the soil, to become a new plant, sustained only by its own life and moisture of the soil and atmosphere till it creates its own root system and becomes an independent plant.

A great many species and varieties must be reproduced by artificial means, as they do not come true from seed, like our own apples and other fruits and many ornamental and greenhouse plants. Others, again, never produce seeds, like the bud varieties, such as the globe and weeping trees and many variegated plants. These bud varieties or sports are chance products of nature, and are in many cases constant; that is, they retain their characteristics unchanged, even when transferred to other soils and climates. One of these varieties is the Lombardy poplar of which I will speak in detail and make my point in regard to the weakening effect mentioned in the title of this paper.

THE LOMBARDY POPLAR (*Populus nigra Italica*). In Lombardy (a province of Italy) a black poplar (*P. nigra*) was found with a branch entirely different from the balance of the tree, which, though somewhat pyramidal in outline, is much more spreading than this particular branch, the twigs of which showed a tendency of growing close together, forming an almost cylindrical mass. The poplars are dioecious trees, having stamens on one plant and pistils on

another. It was a sport on a staminate specimen, and on account of its striking habit was at once propagated, and has since spread over all countries of the globe. This was in the first decade of the eighteenth century, and the tree has, under all conditions of soil and climate, retained its peculiar characteristics unchanged through more than two centuries.

The story of its appearance in continental Europe is as follows: "A merchant in northern Europe received a shipment of fruit from Italy, packed in willow-twig baskets. The merchant noticed that some of the twigs had a very light gray bark. A willow of this color he had never seen before. On close examination he found that the bark was yet green and the buds very little shriveled, so he carefully unwound the baskets and made cuttings of the newly discovered willow. Some of them grew, and proved to be a new and interesting poplar."

From this small start the tree spread rapidly and soon appeared all over Europe, and finally, in less than one hundred years after its first discovery in Italy, was introduced in America.

The striking contrast with other trees and its usefulness in the variation of the sky line made it a desirable material for group and specimen plantings in parks and gardens, and soon was extensively propagated by nurserymen.

In 1872 I saw beautiful, large and healthy specimens in Pennsylvania and New Jersey. Some of them were at least forty years old, perfectly sound and uninjured by wind and cold. But trees I planted in the Topeka parks since 1900 showed unmistakable signs of decay when not more than ten years old, and in a few years more commenced to die and break off.

In examining the young trees when a year old I find that about 10 per cent have not covered the base cut with callus. The cutting turned black about an inch up and a few roots formed from the glands in the bark. By dissecting the plants I found that the decay had followed up the pith the full length of the cutting. The branches and roots were thin and the leaves smaller than those of the healthy plants. Where great care is not exercised in selecting the cuttings it will be seen that this weakness or disease will be inherited by all the descendants of the weak ancestor.

The only way to produce a healthier race of this valuable tree is by careful selection, using the healthiest wood of the healthiest trees, making both the upper and lower cut smooth, by using a sharp knife. Dip the upper cut in oil paint to exclude air and moisture, and protect the lower cut by rubbing powdered charcoal well over the surface, and if possible plant them in a sandy soil.

Problems in Artillery Ammunition Design.

R. A. SEATON.

Because of the very wide field covered by the subject as assigned to me (Scientific Engineering Problems in Ordnance Manufacture), I am limiting myself to one phase only of the subject, as indicated in the title of the paper; and the treatment of this phase is necessarily incomplete because of the limited time at my disposal and because of the complex nature of the subject. The mathematical details are eliminated in so far as possible, and an effort is made to give a more or less popular presentation of the subject in order that you may not be wearied by the more technical details.